

L Number	Hits	Search Text	DB	Time stamp
1	2210	polarimeter	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 08:46
2	200646	retard\$4	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 08:47
3	231	polarimeter and retard\$4	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 08:47
4	253	stokes near5 parameters	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 08:48
5	898	state near3 polarization near4 (measur\$4 or determin\$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 08:49
6	35	(polarimeter and retard\$4) and (stokes near5 parameters)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 09:01
7	77	(polarimeter and retard\$4) and (state near3 polarization near4 (measur\$4 or determin\$4))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 09:01
8	55	((polarimeter and retard\$4) and (state near3 polarization near4 (measur\$4 or determin\$4))) not ((polarimeter and retard\$4) and (stokes near5 parameters))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 09:17
9	2535	wavelength near3 sensor	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 09:18
10	39	retard\$4 and (wavelength near3 sensor)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 09:27
11	2	5841536.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 09:27
12	8	3927945.pn. 6052188.pn. 6043887.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/06/16 09:28

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4904085

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See image for Certificate of Correction

TITLE: Polarimetric fiber optic
sensor testing apparatus

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Brief Summary Text - BSTX (4):

One of the problems associated with conventional polarimeters is that they are limited in the types of polarization states they provide for test purposes and do not provide optical energy in all polarization states. For example, U.S. Pat. No. 2,976,764 to Hyde et al. presents a polarimeter that transmits only linearly or elliptically polarized optical energy, and U.S. Pat. No. 3,741,661 to Yamamoto et al. transmits only circularly polarized optical energy. Accordingly, these polarimeters are limited to testing sensors which are sensitive to optical energy of the particular polarization state offered by the device.

Brief Summary Text - BSTX (5):

A drawback associated with conventional testing apparatus is that they require multiple measurements to determine the polarization state of the optical energy transmitted from the sensor thereby lengthening the testing and

calibration sequence.

Brief Summary Text - BSTX (7):

In view of the above, it is an object of the present invention, among others, to provide a polarimeter which generates and analyzes the polarization state of optical energy.

Brief Summary Text - BSTX (8):

It is another object of the present invention to provide a polarimeter which simultaneously transmits and detects the polarization state of optical energy transmitted through an optical sensor.

Brief Summary Text - BSTX (9):

It is still another object of the present invention to provide a polarimeter which detects and analyzes the polarization state of the light modulated by and transmitted from an optical sensor.

Brief Summary Text - BSTX (10):

In view of these objects, and others, the present invention provides a polarimeter well suited for transmitting optical energy of any state of polarization to a sensor to be tested and simultaneously detecting the polarization state of the optical energy transmitted to the sensor and the optical energy transmitted by the sensor. A light source generates optical energy of a predetermined polarization state, and a polarization conditioner receives the optical energy from the light source

and changes it to any user-selected polarization state. In a preferred embodiment, the polarization conditioner includes a first variable retarder positioned at -45.degree. with respect to the optical axis, a second variable retarder positioned at +45.degree. with respect to the optical axis, and a polarization rotator each placed successively along the optical path. The variable retarders utilize photoelastic blocks which are mechanically stressed to alter their birefringent characteristics, and the polarization rotator can be manually rotated to provide all possible polarization states for the sensor or other optical device under test. A beam splitter sends a component of the optical energy transmitted by the polarization conditioner to a transmit quadrant detector, and another component of the optical energy to the sensor under test. The transmit quadrant detector detects the polarization state of the source optical energy prior to presentation to the sensor under test, and a receive quadrant detector detects the polarization state of the optical energy after its passage through the sensor. The signals from the transmit and receive quadrant detectors are analyzed by a computer or other stored program processor which determines and displays the Stokes vectors computed from the signals received from the quadrant detectors to provide an indication of the modulation effect of the sensor under test.

Drawing Description Text - DRTX (5):

FIG. 4 is a perspective view of a variable retarder of the present invention;

Drawing Description Text - DRTX (6):

FIG. 5 is a perspective view of a photoelastic block incorporated in the variable retarder of FIG. 4;

Drawing Description Text - DRTX (7):

FIG. 6 is a perspective view of a rotatably mounted retarder of the present invention;

Drawing Description Text - DRTX (8):

FIG. 7 is a partial perspective view of a retarder of the present invention taken along the 7--7 line of FIG. 6;

Detailed Description Text - DETX (4):

The linearly polarized light from the polarizer 40 is provided to a polarization conditioning section 50 that includes a first variable retarder 52 aligned at -45.degree. relative the principal optical axis $A_{\text{sub}z}$, a second variable retarder 60 aligned at +45.degree. relative to the optical axis $A_{\text{sub}z}$, a polarization rotator 70, these devices disposed successively along optical axis $A_{\text{sub}z}$ as shown in FIG. 1. As explained below, both of the variable retarders 52 and 60 and the half-wave plate 70 are manually controlled by the user to select the desired polarization state of the output energy.

Detailed Description Text - DETX (12):

The polarization conditioning section 50 of FIG. 1 accepts the optical energy output of the source conditioning section 20 described above and polarizes that energy into a user-selected polarization state using the variable retarders 52 and 60 and the polarization rotator plate 70. The structure of the variable retarders 52 and 60 is shown in FIGS. 4 and 5, and the structure of the polarization rotator 70 is shown in FIGS. 6 and 7.

Detailed Description Text - DETX (13):

As shown in FIGS. 4 and 5, the variable retarders 52 and 60 include a photoelastic block 54 (FIG. 5) disposed within a rigid housing 56 (FIG. 6). The housing 56 has a stationary section 58 that is mounted to the baseplate or chassis (not shown) and a movable section 62 mounted above the stationary section and connected by a pin (not shown) at a hinge or pivot axis 66 to allow the movable section 62 to pivot relative the stationary section 58. The stationary section 58 includes input and output openings (unnumbered) aligned along the optical axis A.sub.z. The photoelastic block 54 is mounted at its lower end by a pin (not specifically shown) along axis 64 and at its opposite, upper end to the movable section 62 by another pin (not shown) along axis 64'. As shown in FIG. 5 the photoelastic block 54 has apertures 55 and 55' aligned with pivot axes 64 and 64' through which pins or other fastening devices may

pass to secure the photoelastic block 54 in place. A manually operated adjustment screw 68 is mounted in threaded engagement with the movable section 62 with the lower end of the adjustment screw contacting a surface on the stationary section 58. As can be appreciated, rotation of the adjustment screw 68 in the clockwise direction will cause the movable section 62 to pivot counterclockwise about the axis 66 relative to the stationary section 56 and place the photoelastic block 54 under tension. In the preferred embodiment, two full clockwise turns of the adjustment screw 68 will place about 20 lbs. of tensile force between the pivot points 64 and 64'. In general and for the particular material and dimensions of the photoelastic block 54, this will allow up to 360.degree. of user-selectable retardation in the optical energy transmitted through the photoelastic block 54. The variable retarders 52 and 60 will rotate the S(1) Stokes component toward or away from the S(3) component adding ellipticity to the optical energy.

Detailed Description Text - DETX (15):

The polarization rotator 70 is embodied as a rotating half-wave plate is shown in FIG. 6 and is mounted so that its fast axis is horizontal in its home position and can be displaced plus or minus 45.degree. relative the horizontal. In one embodiment, two quarter-wave plates are assembled together to define the composite half-wave plate 70. A movable member 72 includes a hollow, cylindrical bushing (unnumbered) in which

the half-wave plate 70 is mounted. The bushing is received in a suitable bore in a stationary mount 76 and is retained in place, as shown in FIG. 7, by a C-clip (unnumbered). The movable member 72 may be any shape and, in the preferred embodiment of FIG. 6, is presented as an inverted sector having a curvilinear peripheral portion that is accessible by the user to rotate the half-wave plate 70 and is mounting bushing. As is in the case of the support 22 of FIG. 2, the stationary mount 76 is provided with feet 76' for mounting upon a baseplate or chassis. Thus, by appropriate tensioning of the photoelastic blocks 54 of the variable retarders 52 and 60 and alignment of the half-wave plate 70, any desired state of polarization can be obtained for subsequent presentation to the sensor under test 190.

Detailed Description Text - DETX (18):

The detector assembly 112 is mounted on a detector support 146 (FIG. 8) by means of the fasteners 148 which are received in apertures 147, as described above. The detector mount 146 houses a photo-detector 150 (FIGS. 9 and 14) which is positioned so that optical energy passing through the aperture 145 passes thereto and impinges on four respective quadrants of the detector plate 150. A suitable photoresponsive detector includes the C30846 quadrant detector provided by the RCA Corporation, Sommerville, N.J. 08876. Each quadrant of the quadrant detector 150 detects its respective quadrant of polarized/retarded

energy and provides its output to the computer 242.

The quadrant detector 110 or 230 is electrically isolated from the above-described components by means of a bushing 154 (FIG. 8) and is mounted on a detector stand 151 by a shaft 152 that protrudes downwardly from the detector mount 146 and is secured into position on a to stand 158.

Claims Text - CLTX (9):

first and second variable retarders; and

Claims Text - CLTX (11):

4. An apparatus as in claim 3 wherein said first detector means to measure the polarization state of said beam transmitted by said polarization changing means is a first quadrant detector and said second detector means to measure the polarization state of said beam transmitted by said sensor is a second quadrant detector.

Claims Text - CLTX (24):

11. An apparatus as in claim 10 wherein said first and second variable retarders each include a photoelastic block and at least one knob to control the tension on said photoelastic block.

Claims Text - CLTX (58):

determining the polarization state of said first component from said detected intensities.

Claims Text - CLTX (66):

determining the polarization state of said beam
transmitted by said second
optical fiber from said detected intensities.

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